

What is claimed is:

1. A chemical mechanical polishing (CMP) apparatus for polishing a surface of a workpiece and for detecting a CMP endpoint, comprising:

an optically transparent polishing belt to polish the surface of the workpiece, the polishing belt being movable in one or more linear directions;

a workpiece holder to support the workpiece, the workpiece holder configured to press the workpiece against the polishing belt;

10 a support plate adapted to support the polishing belt as the workpiece is pressed against the polishing belt; and

15 an optical detection system to detect the CMP endpoint, the optical detection system disposed below the polishing belt and comprising a light source and a detector, the light source sending outgoing signals through the polishing belt to the surface of the workpiece and the detector receiving incoming reflected signals from the surface of the workpiece through the polishing belt.

2. The apparatus according to Claim 1, wherein the optically transparent polishing belt comprises a composite structure.

20 3. The apparatus according to Claim 2, wherein the composite structure is comprised of a first transparent layer placed on a second transparent layer.

25 4. The apparatus according to Claim 3, wherein the first transparent layer is an abrasive layer comprising abrasive particles distributed in a binder matrix.

5. The apparatus according to Claim 4, wherein outgoing signals are a light beam in the wavelength range of 600-900 nanometers.

30 6. The apparatus according to Claim 5, wherein the wavelength of the light beam is 675 nanometers.

7. The apparatus according to Claim 1, wherein the polishing belt is moved bi-directionally.

8. The apparatus according to claim 1, wherein a cavity is defined in the support plate.

9. The apparatus according to claim 8, wherein the optical detection system is mounted within the cavity.

10. The apparatus according to claim 9, wherein a transparent window covers the cavity defined within the support plate, the optical detection system sending and receiving the respective incoming and outgoing signals through the transparent window.

11. The apparatus according to claim 9, wherein the optical detection system is configured to move within the cavity to permit detection of the CMP endpoint over the surface of the workpiece.

12. The apparatus according to claim 9, wherein the optical detection system comprises a plurality of detector devices distributed into a plurality of cavities formed in the support plate so as to monitor multiple areas on the surface of the workpiece.

13. The apparatus of claim 7, wherein the polishing belt uses a polishing solution to polish the surface of the wafer, wherein abrasive particles are dispersed within the polishing solution.

14. The apparatus according to claim 1, wherein the polishing belt has a first end and second end and a polishing side and a backside and further comprising:
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a receive area to which the first end of the polishing belt can be connected;
a supply area to which the second end of the polishing belt can be connected, wherein the support plate provides a path for the polishing belt to travel between the

receive area and the supply area, such that a workpiece polishing area exists along the path.

5 15. A method of polishing a surface of a workpiece and of detecting a chemical mechanical polishing (CMP) endpoint, comprising:

pressing the workpiece against an optically transparent polishing belt, the polishing belt being supported by a support plate;

polishing the surface of the workpiece with the polishing belt, wherein the polishing belt is movable in one or more linear directions;

10 sending outgoing optical signals from a light source through the polishing belt to the surface of the workpiece, the light source disposed below the polishing belt so that the polishing belt is between the light source and the surface of the workpiece; and

15 receiving, at a detector, incoming reflected optical signals from the surface of the workpiece through the polishing belt and the support plate, the detector disposed below the polishing belt.

20 16. The method according to Claim 14, wherein sending signals and receiving signals steps uses a light beam of 600-900 nanometers wavelength range.

17. The method according to Claim 15, wherein the light beam has a wavelength of 675 nanometers.

25 18. The method according to claim 14, further comprising the step of moving the light source and the detector to permit detection of the CMP endpoint over the surface of the workpiece.

19. A method of polishing one or more workpieces and of providing chemical mechanical polishing (CMP) endpoint detection, comprising:

30 providing an optically transparent polishing belt between a supply area and a receive area, the polishing belt having a first end and a second end and a polishing side and a backside, such that the first end initially comes off the supply area and is

connected to the receive area and the second end remains connected to the receive area;

polishing a first workpiece by moving a portion of the polishing belt in one or more linear directions within a polishing area; and

5 detecting a first CMP endpoint of the first workpiece using an optical detection system, the optical detection system sending outgoing signals to and receiving incoming reflected signals from the first workpiece through the polishing belt, the polishing belt being located between the optical detection system and the first workpiece.

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20. The method according to claim 18, further comprising the step of introducing the first workpiece to the polishing area prior to polishing the first workpiece with the portion of the polishing belt.

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21. The method according to claim 18, further comprising changing a set of process conditions for a polishing sequence corresponding to the first CMP endpoint of the first workpiece to a second set of process conditions for a second polishing sequence corresponding to a second CMP endpoint of the first workpiece when the first CMP endpoint is detected.

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22. The method according to claim 20, wherein the first CMP endpoint corresponds to removal of a metal overburden layer from the first workpiece.

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23. The method according to claim 21, wherein the second CMP endpoint corresponds to removal of a barrier layer from the first workpiece.

24. The method according to claim 18, further comprising the step of removing the first workpiece when the first CMP endpoint is detected

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25. A method of polishing a surface of a workpiece and of detecting a chemical mechanical polishing (CMP) endpoint, comprising:

supporting the workpiece such that the surface of the workpiece is exposed to a section of an optically transparent polishing belt in a processing area; and

polishing the surface of the wafer by moving the section of the polishing belt bi-directional linearly; and

5 determining a CMP endpoint for the workpiece by sending outgoing optical signals through the polishing belt to the workpiece and continuously examining the relative intensity of incoming optical signals reflected from the workpiece and received through the polishing belt.

10 26. A method according to claim 24, wherein the polishing belt is moved with a driving mechanism that generates the bi-directional linear movement.

27. A method according to claim 24, wherein the CMP endpoint occurs when an observed optical signal intensity reaches a first level, the CMP endpoint corresponding to removal of a metal overburden layer.

15 28. A method according to claim 26, wherein the step of determining is used to determine a second CMP endpoint for the workpiece.

20 29. A method according to claim 27, wherein the second CMP endpoint occurs when the observed optical signal intensity reaches a second level, the CMP endpoint corresponding to removal of a barrier layer.

25 30. The method according to claim 25, further comprising the step of advancing the polishing belt to obtain another portion that will be used for polishing.

31. The method according to claim 30, further comprising the steps of: removing the first workpiece when the first CMP endpoint is detected, introducing a second workpiece to the polishing area; and polishing the second workpiece by moving the another portion of the polishing belt in one or more linear directions within the polishing area.